Southwest Fisheries Science Center
Santa Cruz Laboratory
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October 1, 2004 F/SWC3 : KAB

CRUISE REPORT

VESSEL: **NOAA R/V DAVID STARR JORDAN, DS 04-03**

CRUISE DATES: **MAY 4 - JUNE 11, 2004**

PROJECT: **Rockfish Recruitment Assessment, Groundfish Analysis Team**

BACKGROUND:

Rockfish (*Sebastes* spp.) are an important component of both the recreational and commercial fisheries off the west coast of North America. In recent years, significant reductions in the biomass of many of these species have been observed. The reductions likely stem from a combination of heavy fishing pressure and poor recruitment, due to poor survival of larvae within the first few weeks of life. Adult rockfish are often unavailable to commercial fishing gears until they are 3-7 years old, so a preview of future recruitments can be valuable in modeling population growth and determining allowable harvest levels. It is difficult to assess the abundance of younger rockfish due to the inaccessible habitats where they live. However, a part of their early life history involves a pelagic juvenile stage that allows them to be sampled effectively. Since 1983, personnel from the Groundfish Analysis Team of the NOAA Fisheries Santa Cruz Laboratory (formerly the NOAA Fisheries SWFSC Tiburon Laboratory) along with the NOAA Ship DAVID STARR JORDAN have conducted annual surveys off central California to assess the spawning success and future recruitment of over 2 dozen rockfish species.

ITINERARY:

LEG 1: May 3- May 14, 2004

The annual juvenile rockfish survey began in San Diego on May 4, 2002 after one day of scientific embarkation, gear/laboratory setup, and final repairs to the Ship's shaft seal on May 3. The Ship departed MARFAC San Diego (homeport) the morning of May 4 and conducted sea trials for the Simrad ITI system, the re-engineered net reel system, the new mid-water trawl net, and the CTD system. Beginning the night of May 4 and ending the morning of May 14 the Ship and scientists conducted mid-water trawls, CTD deployments, physical oceanographic sampling, and bird/marine mammal observations at stations along the designated transects. 24 hours were

devoted to each transect. The transects covered during Leg 1, in chronological order, were; San Clemente, San Nicolas, San Miguel, Vandenberg, Piedras Blancas, Monterey Bay Inside, Monterey Bay Outside, Davenport, Pescadero, Outside Farallon Islands.

LEG 2: May 14 - May 21, 2004

Exchanged scientists the morning of May 14 at Horseshoe Cove, near the Golden Gate Bridge. During the afternoon of May 14, the Ship made a site visit to Southeast Farallon Island. Beginning the night of May 14 and ending the morning of May 21 the Ship and scientists conducted mid-water trawls, CTD deployments, physical oceanographic sampling, and bird/marine mammal observations at stations along the designated transects. The transects covered during Leg 2, in chronological order, were; Inside Gulf of the Farallones, Point Reyes, Fort Ross, Navarro, Delgada, Fort Ross, Outside Farallon Islands.

INPORT San Francisco: May 22

At the end of leg 2, on the morning of May 21, the Ship docked at Pier 27 in San Francisco. One entire day was spent in port on May 22.

LEG 3: May 23 - May 29

Embarked scientists the morning of May 23 and departed Pier 27, San Francisco. Beginning the night of May 23 and ending the morning of May 29 the Ship and scientists conducted mid-water trawls, CTD deployments, and physical oceanographic sampling at stations along the designated transects. Hook and Line sampling for adult groundfish off Davenport, CA was conducted during the late afternoon of May 25 and in the afternoon of May 27 on Fanny Shoal. The transects covered during Leg 3, in chronological order, were; Monterey Bay Inside, Monterey Bay Outside, Davenport, Pescadero, Inside Gulf of the Farallones, Outside Farallon Islands. Weather was to rough to attempt the Point Reyes transect on May 29.

LEG 4: May 30 - June 6

Embarked scientists the morning of May 30 at Pillar Point Harbor, Half Moon Bay. Beginning the night of May 30 and ending the morning of June 6, the Ship and scientists conducted mid-water trawls, CTD deployments, physical oceanographic sampling, and bird/marine mammal observations at stations along the designated transects. Rough weather impeded trawling operations for several days during this Leg and planned transects were altered due to the rough weather. The transects covered during Leg 4, in chronological order, were; Monterey Bay Inside, Davenport, Outside Monterey Bay, and Inside Monterey Bay.

LEG 5: June 6 - June 11

Embarked scientists the morning of June 6 off Santa Cruz Harbor. Beginning the night of June 7 and ending the morning of June 11, the Ship and scientists conducted mid-water trawls, CTD deployments, and physical oceanographic sampling at stations along the designated transects. Rough weather impeded trawling operations for the planned transects at Piedras Blancas and Vandenberg, so the ship transited south into the Southern CA bight on June 6. The transects covered during Leg 5, in chronological order, were San Nicolas, San Miguel, San Clemente, and an exploratory transect close to San Diego.

OBJECTIVES:

1. To determine the distribution and abundance of juvenile rockfish between San Clemente Island and Delgada, CA and their relationship with oceanographic conditions (temperature, salinity, currents, chlorophyll, etc.).

2. To characterize prominent biological and physical oceanographic features.

3. To map the distribution and abundance of krill along the California continental shelf and shelf break.

4. To observe seabird and marine mammal distribution and abundance.

5. To collect adult groundfish species for ecological and life history characteristics, such as age, growth rates, and reproductive status.

PIGGYBACK PROJECTS:

1. Radiography of Juvenile Pacific Whiting (Hake), *Merluccius productus* to determine swim bladder characteristics. In cooperation with the University of Washington, Seattle, WA.

2. Side-by side trawling gear comparisons with the Pacific Whiting Conservation Cooperative's vessel EXCALIBUR and cooperative survey of juvenile hake and rockfish relative abundance.

3. Collect lengths and weights and specimens of market squid (Loligo opalescens) for NOAA Fisheries SWFSC La Jolla Laboratory and for the University of California, Santa Cruz.

METHODS:

1. Juvenile Rockfish Survey:
In general, 5-7 midwater trawls, each of 15 minute duration, were conducted each night between 2100-0500 Pacific Standard Time. Standardized mid-water trawls were conducted at the stations along 15 transects within the survey area, between San Diego and Delgada CA. The trawl stations remained in the same location and are sampled in a consistent manner from year to year. There were a total of 74 standard mid-water trawl stations of fixed geographic locations. All fish species caught in the trawls were identified and enumerated. Selected species were frozen for later analyses. Selected invertebrates were also identified and enumerated. Following is a list of the mid-water trawl and CTD stations along with the geographic location for each station, the depth of the bottom at the station, the estimated trawl warp or hydrographic winch cable wire out to be used for that station's trawl or CTD, and the station's ID number. The list for each transect is in chronological order when sampling at that transect.

Juvenile Rockfish Survey Trawl and CTD Stations at each Transect

NIGHT: TRAWL & CTD - SAN CLEMENTE TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	32° 43'	118° 09.3'	1000	520	401
trawl	32° 43'	118° 09.3'	1000	85	401
trawl	32° 43'	118° 27.2'	270	85	402
CTD	32° 43'	118° 27.2'	270	260	402
CTD	32° 43'	118° 44.9'	1284	520	403
trawl	32° 43'	118° 44.9'	1284	85	403
trawl	32° 43'	119° 03'	500	85	404
CTD	32° 43'	119° 03'	500	490	404

DAY: CTD - SAN NICHOLAS TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	33° 31.29'	119° 15.4'	985	520	4001
CTD	33° 24.34'	119° 24.2'	963	520	4002
CTD	36° 18.7'	119° 33.35'	55	50	4003
CTD	33° 12.62'	119° 44.25'	460	450	4004
CTD	33° 26.54'	120° 01.55'	976	520	4005
CTD	33° 32.5'	119° 51.37'	330	320	4006
CTD	33° 37.75'	119° 41.63'	1366	520	4007
CTD	33° 44.55'	119° 32.46'	1930	520	4008

NIGHT: TRAWL & CTD - SAN NICHOLAS TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	33° 41.4'	119° 17.2'	886	520	411
trawl	33° 41.4'	119° 17.2'	886	85	411
trawl	33° 35.2'	119° 26.9'	1874	85	412
CTD	33° 35.2'	119° 26.9'	1874	520	412
CTD	33° 29.2'	119° 36.3'	769	520	413
trawl	33° 29.2'	119° 36.3'	769	85	413
trawl	33° 23'	119° 45.8'	107	85	414
CTD	33° 23'	119° 45.8'	107	97	414
trawl	33° 17.1'	119° 55.5'	956	85	415
CTD	33° 17.1'	119° 55.5'	956	520	415

DAY: CTD - SAN MIGUEL TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	33° 57.4'	120° 25.5'	165	155	4009
CTD	33° 49.28'	120° 33.1'	1819	520	4010
CTD	34° 01.77'	120° 51.57'	948	520	4011
CTD	34° 09.75'	120° 44.6'	738	450	4012
CTD	34° 17.73'	120° 37.47'	515	505	4013
CTD	34° 24.96'	120° 29.62'	100	90	4014

NIGHT: TRAWL & CTD - SAN MIGUEL TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	34° 26.59'	120° 12.68'	73	63	421
trawl	34° 26.59'	120° 12.68'	73	85	421
trawl	34° 18.9'	120° 20.45'	355	85	422
CTD	34° 18.9'	120° 20.45'	355	345	422
CTD	34° 10.6'	120° 28.3'	149	140	423
trawl	34° 10.6'	120° 28.3'	149	140	423
trawl	34° 04.2'	120° 34.7'	159	85	424
CTD	34° 04.2'	120° 34.7'	159	150	424
trawl	33° 55.1'	120° 42.7'	1848	85	425
CTD	33° 55.1'	120° 42.7'	1848	520	425

DAY: CTD - VANDENBERG TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	34° 26.8'	120° 44.3'	493	483	4015
CTD	34° 26.8'	120° 57'	900	520	4016
CTD	34° 26.8'	121° 09'	1413	520	4017
CTD	34° 26.8'	121° 21.25'	2148	520	4018
CTD	34° 47.1'	121° 21.25'	482	470	4019
CTD	34° 47.1'	121° 08.9'	566	520	4020
CTD	34° 47.1'	120° 56.58'	304	294	4021
CTD	34° 47.1'	120° 44.48'	77	70	4022

NIGHT: TRAWL & CTD - VANDENBERG TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	34° 37'	120° 42.5'	60	50	431
trawl	34° 37'	120° 42.5'	60	85	431
trawl	34° 37'	120° 45.75'	92	85	432
CTD	34° 37'	120° 45.75'	92	85	432
CTD	34° 37'	120° 51.75'	308	300	433
trawl	34° 37'	120° 51.75'	308	85	433
trawl	34° 37'	121° 10'	154	85	434
CTD	34° 37'	121° 10'	154	145	434
trawl	34° 37'	121° 30'	1440	85	435
CTD	34° 37'	121° 30'	1440	520	435

DAY: CTD - PIEDRAS BLANCAS TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	35° 32.12'	121° 21.8'	516	506	4023
CTD	35° 32.12'	121° 34.1'	848	520	4024
CTD	35° 32.12'	121° 46.3'	1007	520	4025
CTD	35° 32.12'	121° 58.8'	1258	520	4026
CTD	35° 52'	121° 58.8'	1353	520	4027
CTD	35° 52'	121° 46.4'	968	520	4028
CTD	35° 52'	121° 34'	510	500	4029

NIGHT: TRAWL & CTD - PIEDRAS BLANCAS TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	35° 42.2'	121° 21.8'	60	50	441
trawl	35° 42.2'	121° 21.8'	60	85	441
trawl	35° 42.2'	121° 25.75'	167	85	442
CTD	35° 42.2'	121° 25.75'	167	85	442
CTD	35° 42.2'	121° 30.5'	557	520	443
trawl	35° 42.2'	121° 30.5'	557	85	443
trawl	35° 42.2'	121° 49'	1011	85	444
CTD	35° 42.2'	121° 49'	1011	520	444
trawl	35° 42.2'	122° 10.9'	1711	85	445
CTD	35° 42.2'	122° 10.9'	1711	520	445

NIGHT: TRAWL & CTD - MONTEREY BAY INSIDE TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	36° 50.8'	121° 59'	91	81	119
trawl	36° 50.8'	121° 59'	91	85	119
trawl	36° 46'	121° 52'	73	85	114
CTD	36° 46'	121° 52'	73	63	114
CTD	36° 44.4'	121° 58.6'	238	228	116
trawl	36° 44.4'	121° 58.6'	238	85	116
trawl	36° 42.5'	121° 54.5	91	85	115
CTD	36° 42.5'	121° 54.5	91	81	115
CTD	36° 38.5'	121° 51.5'	37	30	111
trawl	36° 38.5'	121° 51.5'	37	25	111
trawl	36° 39.3'	121° 56.8'	73	85	112
CTD	36° 39.3'	121° 56.8'	73	63	112

DAY: CTD - MONTEREY BAY OUTSIDE TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	36° 40'	122° 10'	1134	520	1002
CTD	36° 46.3'	122° 16.1'	823	520	1003
CTD	36° 46.3'	122° 28.4'	2100	520	1004
CTD	36° 40'	122° 22.3'	1737	520	1005
CTD	36° 33.7'	122° 16.2'	2560	520	1006
CTD	36° 33.7'	122° 28.4'	2743	520	1007
CTD	36° 40'	122° 34.6'	2377	520	1008
CTD	36° 46.3'	122° 40.7'	2148	520	1009
CTD	36° 33.7'	122° 40.7'	2740	520	1010

NIGHT: TRAWL & CTD - MONTEREY BAY OUTSIDE TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	36° 35'	122° 10.5'	2322	520	110
trawl	36° 35'	122° 10.5'	2322	25	110
trawl	36° 35'	122° 10.5'	2322	85	110
trawl	36° 35'	122° 10.5'	2322	215	110
CTD	36° 35'	122° 2'	530	510	109
trawl	36° 35'	122° 2'	530	85	109
trawl	36° 38.8'	122° 3'	914	85	113
CTD	36° 38.8'	122° 3'	914	520	113

CTD	36° 42'	122° 6.5'	1920	520	117
trawl	36° 42'	122° 6.5'	1920	85	117
trawl	36° 46.4'	122° 9'	914	85	118
CTD	36° 46.4'	122° 9'	914	520	118

DAY: CTD - DAVENPORT TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	36° 52.6'	122° 10'	91	81	1011
CTD	36° 52.6'	122° 22.3'	823	520	1012
CTD	36° 52.6'	122° 34.6'	1600	520	1013
CTD	36° 52.6'	122° 47'	2286	520	1014
CTD	36° 52.6'	122° 59.3'	2697	520	1015
CTD	36° 59'	122° 53'	1372	520	1016
CTD	37° 5'	122° 47'	686	520	1017
CTD	37° 5'	122° 34.6'	119	110	1018
CTD	37° 5'	122° 22.3'	59	50	1019

NIGHT: TRAWL & CTD - DAVENPORT TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	36° 59'	122° 17.5'	82	72	123
trawl	36° 59'	122° 17.5'	82	85	123
trawl	36° 59'	122° 22.5'	128	85	124
CTD	36° 59'	122° 22.5'	128	118	124
CTD	36° 59'	122° 25.5'	457	445	125
trawl	36° 59'	122° 25.5'	457	85	125
CTD	36° 59'	122° 35.5'	402	390	126
trawl	36° 59'	122° 35.5'	402	85	126
trawl	36° 59'	122° 45.5'	1085	85	127
CTD	36° 59'	122° 45.5'	1085	520	127

DAY: CTD - PESCADERO TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	37° 10.7'	122° 28.4'	68	58	1020
CTD	37° 10.7'	122° 40.7'	110	100	1021
CTD	37° 10.7'	122° 53'	420	410	1022
CTD	37° 10.7'	123° 5.3'	870	520	1023
CTD	37° 16.5'	123° 11.4'	1190	520	1024
CTD	37° 22.3'	123° 5.3'	823	520	1025
CTD	37° 22.3'	122° 53'	200	190	1026
CTD	37° 22.3'	122° 40.7'	88	78	1027
CTD	37° 22.3'	122° 28.4'	27	20	1028

NIGHT: TRAWL & CTD - PESCADERO TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	37° 16.5'	122° 34'	82	75	131
trawl	37° 16.5'	122° 34'	82	85	131
trawl	37° 16.5'	122° 39'	95	85	132
CTD	37° 16.5'	122° 39'	95	85	132
CTD	37° 16.5'	122° 49'	165	155	133

trawl	37° 16.5'	122° 49'	165	85	133
CTD	37° 16.5'	122° 59'	550	520	134
trawl	37° 16.5'	122° 59'	550	85	134
trawl	37° 16.5'	123° 09'	1006	85	135
CTD	37° 16.5'	123° 09'	1006	520	135

DAY: CTD - OUTSIDE FARALLON ISLANDS TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	37° 30.8'	122° 59.3'	230	220	1029
CTD	37° 30.8'	123° 11.6'	1280	520	1030
CTD	37° 30.8'	123° 24'	2377	520	1031
CTD	37° 30.8'	123° 36.3'	2652	520	1032
CTD	37° 38.4'	123° 36.3'	3338	520	1033
CTD	37° 46.2'	123° 36.3'	2700	520	1034
CTD	37° 46.2'	123° 24'	1510	520	1035
CTD	37° 46.2'	123° 11.6'	128	118	1036

NIGHT: TRAWL & CTD - OUTSIDE FARALLON ISLANDS TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	37° 39.5'	123° 2.5'	120	110	152
trawl	37° 39.5'	123° 2.5'	120	85	152
trawl	37° 39.5'	123° 12.5'	1245	85	154
CTD	37° 39.5'	123° 12.5'	1245	520	154
CTD	37° 44.6'	123° 8.3'	91	81	156
trawl	37° 44.6'	123° 8.3'	91	85	156
CTD	37° 53'	123° 19'	91	81	160
trawl	37° 53'	123° 19'	91	85	160
trawl	37° 53'	123° 30'	1463	85	162
CTD	37° 53'	123° 30'	1463	520	162

NIGHT: TRAWL & CTD - GULF OF THE FARALLONES TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	37° 47.5'	122° 52'	55	45	139
trawl	37° 47.5'	122° 52'	55	25	139
trawl	37° 42'	122° 54.5'	55	25	138
CTD	37° 42'	122° 54.5'	55	45	138
CTD	37° 35.8'	122° 49.9'	55	45	237
trawl	37° 35.8'	122° 49.9'	55	25	237

DAY: CTD - POINT REYES TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	38° 1.6'	123° 17.8'	120	110	1045
CTD	38° 1.6'	123° 5.5'	64	54	1046
CTD	38° 1.6'	123° 30.1'	137	127	1037
CTD	38° 1.6'	123° 42.4'	2560	520	1038
CTD	38° 1.6'	123° 54.7'	3475	520	1039
CTD	38° 18.5'	123° 42.4'	1463	520	1042
CTD	38° 18.5'	123° 30.1'	275	265	1043
CTD	38° 18.5'	123° 17.8'	110	100	1044

NIGHT: TRAWL & CTD - POINT REYES TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	38° 10'	123° 29'	285	275	171
trawl	38° 10'	123° 29'	285	85	171
trawl	38° 10'	123° 22'	183	85	170
CTD	38° 10'	123° 22'	183	173	170
CTD	38° 10'	123° 17'	128	118	168
trawl	38° 10'	123° 17'	128	85	168
trawl	38° 10'	123° 10'	91	85	167
CTD	38° 10'	123° 10'	91	81	167
CTD	38° 9.5'	123° 5'	73	63	166
trawl	38° 9.5'	123° 5'	73	85	166
trawl	38° 10'	123° 0'	55	25	165
CTD	38° 10'	123° 0'	55	45	165

DAY: CTD - FORT ROSS TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	38° 10'	124° 07'	3658	520	1040
CTD	38° 18.5'	123° 54.7'	2835	520	1041
CTD	38° 18.5'	124° 07.7'	3600	520	4030
CTD	38° 28'	124° 14.7'	3500	520	4031
CTD	38° 37.85'	124° 07.7'	1413	520	4032
CTD	38° 37.85'	123° 56'	1805	520	4033
CTD	38° 37.85'	123° 43.3'	245	235	4034
CTD	38° 37.85'	123° 30.25'	98	88	4035

NIGHT: TRAWL & CTD - FORT ROSS TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	38° 28'	123° 14'	60	50	451
trawl	38° 28'	123° 14'	60	85	451
trawl	38° 28'	123° 18.5'	92	85	452
CTD	38° 28'	123° 18.5'	92	82	452
CTD	38° 28'	123° 23.2'	115	105	453
trawl	38° 28'	123° 23.2'	115	85	453
trawl	38° 28'	123° 42.6'	910	85	454
CTD	38° 28'	123° 42.6'	910	520	454
trawl	38° 28'	124° 05'	3350	85	455
CTD	38° 28'	123° 05'	3350	520	455

DAY: CTD - NAVARRO TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	38° 58'	123° 47'	72	62	4036
CTD	38° 58'	123° 59.8'	500	490	4037
CTD	38° 58'	124° 12.8'	2000	520	4038
CTD	38° 58'	124° 25.6'	3500	520	4039
CTD	39° 08'	124° 28'	3200	520	4040
CTD	39° 18	124° 25.6'	2200	520	4041
CTD	39° 18'	124° 12.8'	1200	520	4042
CTD	39° 18'	123° 59.8'	400	390	4043

CTD	39° 18'	123° 49'	30	25	4044

NIGHT: TRAWL & CTD - NAVARRO TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	39° 08'	123° 45.75'	50	40	461
trawl	39° 08'	123° 45,75'	50	85	461
trawl	39° 08'	123° 51'	100	85	462
CTD	39° 08'	123° 51'	100	90	462
CTD	39° 08'	124° 00'	500	490	463
trawl	39° 08'	124° 00'	500	85	463
trawl	39° 08'	124° 19'	2000	85	464
CTD	39° 08'	124° 19'	2000	520	464
trawl	39° 08'	124° 37'	3300	85	465
CTD	39° 08'	123° 37'	3300	520	465

DAY: CTD - DELGADA TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	39° 40'	123° 50'	60	50	4045
CTD	39° 40'	124° 03'	600	520	4046
CTD	39° 40'	124° 16'	1400	520	4047
CTD	39° 40'	124° 29'	2100	520	4048
CTD	39° 50'	124° 34.5'	1300	520	4049
CTD	40° 00	124° 42.25'	1000	520	4050
CTD	40° 00'	124° 29'	1000	520	4051
CTD	40° 00'	124° 16'	900	520	4052
CTD	40° 00'	124° 06'	45	35	4053

NIGHT: TRAWL & CTD - DELGADA TRANSECT

OPS	*Latitude*	*Longitude*	*Depth(m)*	*Wire Out(m)*	*Station*
CTD	39° 50'	123° 55'	60	50	471
trawl	39° 50'	123° 55'	60	85	471
trawl	39° 50'	123° 58.8'	120	85	472
CTD	39° 50'	123° 58.8'	120	110	472
CTD	39° 50'	124° 06.5'	300	290	473
trawl	39° 50'	124° 06.5'	300	85	473
trawl	39° 50'	124° 24'	1500	85	474
CTD	39° 50'	124° 24'	1500	520	474
trawl	39° 50'	124° 45'	1300	85	475
CTD	39° 50'	123° 45'	1300	520	475

Figures 1 and 2 illustrate the survey's mid-water trawl and CTD stations.

Target headrope depths, while trawling, were achieved and maintained by a set amount of wire out for the trawl warps and a variable rate of speed through the water which maintained the Simrad ITI headrope sensor at the desired depth. A Vemco TDR (temperature- depth recorder) was also attached to the trawl net's headrope and footrope during deployments. The Vemco TDR provided retrospective data on headrope depth and seawater temperature at the headrope and footrope. The Vemco TDR records this information every 10 seconds. In addition, four SIMRAD ITI acoustic sensors (trawl-eye, depth-temp, port wing spread, starboard wing spread) are attached to the headrope and to the net wings near the center of the breast lines during deployments. The SIMRAD ITI provided real-time information on headrope depth, footrope depth, distance between spread sensors, and seawater temperature at the headrope. The SIMRAD ITI information is refreshed and recorded on a 30 second interval. During mid-water trawl deployments (setting, fishing, retrieving), the Ship's speed was between 1.5-2.5 knots, (speed through the water). For a target headrope depth of 30 meters we used 85 meters of warp. For a target headrope depth of 100 meters we used 215 meters of warp. For a target headrope depth of 7 meters we used 25 meters of warp. The Ship's speed and direction, during some tows, were altered to achieve the target headrope depth and for aligning of the codend directly astern the Ship. The standard duration for fishing the trawl net at the target headrope depths was constant, at 15 minutes. In areas of high jellyfish concentrations, "test" trawl deployments were made with a 5 minute duration, at target depth. The fishing at target headrope depth begins when the designated amount of warp is out, with winches braked. All aft deck lights were turned off when the net was at target depth so that no lights were visible when the net is fishing at depth. An acceptable standard 30 meter target depth tow normally took 10 minutes to set and 10 minutes to retrieve. The standard tow direction was downwind with following seas dead astern. If both the wind and seas were calm then the tow direction was towards the next trawl station. In high cross currents, the course was altered into or with the current. Fish, shrimp, squid, and krill from each trawl were sorted, identified and enumerated. Juvenile rockfish, market squid, selected Hake, selected juvenile flatfish, and salmon were frozen for laboratory analyses. CTD casts using the port J-frame were conducted throughout the day in the vicinity of the trawl transects and at each trawl station at night. Some CTDs were excluded during daytime and night-time operations in the interests of the time needed to complete planned mid-water trawls. A Seabird Electronics Seacat 19+ CTD was used in conjunction with a Seabird Electronics Model 32/33 Carousel Water Sampling System. The CTD was lowered to a maximum depth of 520 m, or 10 meters from the bottom, as bottom depth allowed. Deployment rate: soak CTD for 2 minutes at 10 meters depth, then beginning at the surface, 45 m/min for the downcast, and 60 m/min for the upcast. Water samples were taken, on average, three times every 24 hours, for chlorophyll and nutrient analysis. Water samples were collected during the upcast with the Niskin Bottles which were attached to the Seabird carousel.

2. Survey of Prominent Biological and Physical Oceanographic Features:
A Simrad EK500 echosounder was used to acoustically characterize the distribution and abundance of macro-zooplankton and micro-nekton, meroplankton and zooplankton. Acoustic data were collected continuously throughout the cruise. The echo sounder was configured with down-looking 38, 120, and 200 kilohertz (kHz) transducers mounted in the hull. During the survey, the EK500 was configured to transmit pulses every 2 seconds at 1 kilowatt for 1 millisecond duration. Geographic positions were obtained from the ship's GPS and logged every

60 seconds. Ethernet communications were maintained between the EK500 and a Windows based PC which logged the EK500 telegrams using EchoLog software. Data were displayed in the aft lab using Sonardata's EchoView software.
An RDI Acoustic Doppler Current Profiler recorded data continuously while underway to determine subsurface current velocity and direction. The hull mounted ADCP recorded horizontal and vertical velocity as a function of depth by using the Doppler effect to measure the radial relative velocity between the instrument and scatterers in the ocean. The CalCOFI ue4m.exe ADCP setup configuration was used to input navigational data from the Ship's GPS and gyrocompass into the ADCP Data Acquisition Software (DAS). The ADCP transmits a ping from its transducer elements roughly once per second. Profiles were produced and displayed on a PC by range-gating the echo signal, which produces successive segments called depth bins. The noisy velocity estimates from each ping are vector averaged into ensembles which are subsequently saved to computer disk.
A permanently mounted Seabird thermosalinometer continuously recorded seawater temperature and salinity while underway. The thermosalinometer measures water that is continually pumped from a sea-chest located in the Ship's hull at a water depth of 3 meters. This data was used for comparisons with CTD casts and for estimating oceanographic frontal areas. All the thermosalinometer data was saved to computer disk.
A Turner Designs SCUFA fluorometer was configured to record relative chlorophyll data continuously while underway. The fluorometer was bench-mounted with a seawater flow-through system attached. The flow-through seawater was pumped up the laboratory bench-top flow-through system from the Ship's hull at a depth of 3 meters. The chlorophyll data was combined with the Ship's GPS location data and with date-time information via the Ship's SCS and subsequently saved to computer disk.

3. Map the Distribution and Abundance of Krill Along the Continental Shelf and Shelf Break off California:
Daytime EK500 transects, and daytime transits, with good EK500 acoustic-recording surface weather conditions, were carried out during the course of the cruise. The EK500 recorded nearly continuously while underway. Daytime tucker trawls near acoustic signatures were used to verify species of krill.

4. Seabird and Marine Mammal Observations:
Ornithologists from PRBO Conservation Science (formerly Point Reyes Bird Observatory) were aboard during Legs 1 and 2. Seabirds were enumerated and identified in an arc from the bow to 90º amidships. All seabirds passing through this area in flight or observed sitting or foraging were counted. Marine mammals were observed to the horizon. Distance and angle from the ship to each individual mammal or group of mammals was estimated. Data were entered as observations into a Husky Fex21 palmtop computer using program FLK (courtesy George Hunt).
Ornithologists from the H. T. Harvey & Associates Ecological Consultants were aboard during Leg 4. The ornithologists estimated the distribution and abundance of seabirds and marine mammals while underway. Carol Keiper and Ian Gaffney used standardized population censussing techniques to survey the marine birds and marine mammals. Observers censussed birds continuously from the Ship's flying bridge during daylight hours while the vessel was underway at speeds of 7 knots (9 km /h) or greater. A range-finder was used to estimate the width of the survey transect and only those birds sighted within a 300 meter arc from the bow

(directly ahead) to 90 º off the side with best visibility (e.g., least glare) were logged into a field computer. Ship-following birds were recorded the first time they were detected and were ignored thereafter. The observers estimated the range to marine mammal sightings and recorded them, regardless of their perpendicular distance to the vessel.

5. Collection of Adult Groundfish Species for Ecological and Life History Characteristics:
Hook and line fishing with rod and reel for adult groundfish species was conducted during daylight hours at 4 different locations during the cruise. Nearshore fishing locations were Fanny Shoal, Cordell Bank, off Davenport, and near the Natural Bridges area off Santa Cruz. Otoliths were removed from all fish and ovaries from those in spawning condition. Gender and reproductive condition of gonads was recorded for all fish captured.

PIGGYBACK PROJECTS:

1. Radiography of Juvenile Hake by Mark Henderson , University of WA**:**
The bodies and swim bladders of Pacific Whiting (Hake) were carefully measured through X-ray imagery (radiography) after super-cool ethanol freezing of freshly caught juveniles and sub-adults from the night-time mid-water trawls. MS-222 (Tricaine Methanesulfonate) was used as an anesthesia in the super-cool ethanol bath. An aerated seawater recovery bath was used as well. Hake specimens were bagged and preserved in a regular freezer after the radiography procedure and taken to the University of Washington, Seattle WA, by researcher, Mark Henderson.

2. Side-by-side (Synchronized) trawl gear comparisons with the PWCC RV EXCALIBUR:
Similar trawl nets were used on each of the 2 research vessels and target headrope depths were matched. Trawl gear from each vessel was deployed within 1/4 nm of one another at the same times throughout the night. Juvenile and YOY hake catch data was shared between the 2 vessels for each side-by-side trawl. Juvenile rockfish specimens caught by the EXCALIBUR during the side-by-side comparison trawls were frozen and transferred to the NMFS SWFSC Santa Cruz scientists for accurate identification and enumeration.

3. Market Squid Collections:
Market Squid (*Loligo opalescens*) were preserved (frozen) from each trawl, in which squid were caught, for UC Santa Cruz. Dorsal mantle lengths were measured for all squid captured or 50 individuals, whichever was less, per trawl. Pre-frozen weights and dorsal mantle lengths were taken on individuals for the NOAA Fisheries La Jolla Laboratory. Individuals were frozen as soon as possible after the trawl for subsequent analysis.

RESULTS:

1. Juvenile Rockfish Survey:
A total of 145 successful night-time midwater trawls were completed, out of 150 attempted, during the 5 Legs of the survey. This is the highest number of trawls completed in a single survey, compared to all the previous annual surveys. We expanded our total days at sea and increased the number of trawl stations both to the south and north of the usual central California trawl stations. In relation to the 22 year history of this project we observed a very good year in the catches of juvenile rockfish, with a total juvenile rockfish catch (5889) similar to what was caught in 2001, and 1990-1991. There were 3 species (Bocaccio, Squarespot, Shortbelly) which fell below the long term mean for the survey catches. Many of the fish were large, a condition usually associated with good survival. The abundance of shortbelly rockfish (Sebastes jordani), which dominated catches in the late 1980s, was relatively low, although the standard score was slightly higher than last year's shortbelly score. We observed the highest catches ever for a handful of juvenile Sebastes spp. (widow, yellowtail, blue, black, and canary). A significant factor for the record high catches of these 5 species was the 74th trawl of the survey off Delgada CA, which yielded 749 widow, 339 yellowtail, 305 blue, 91 black, and 59 canary rockfish. The trawl stations off Delgada are new for 2004 and north of the previous years' survey area. We caught a relatively large number of unknown Sebastes spp. juveniles which require genetic analysis for accurate identification. Most of these unknown juvenile rockfish were caught in the new southern California trawl stations. We also caught a record high number (423) of Sebastomus spp. juveniles. The previous high total number of Sebastomus spp. was 27, which were caught in 1997. The Sebastomus spp. juveniles were captured in the newly designated Southern California Bight trawl stations, which probably accounts for the lower abundances of these species in previous years' surveys.
Marine scientists from the University of California at Santa Cruz also participated in the cruise in order to research the abundance and feeding behavior of market squid and to collaborate with the NMFS Santa Cruz Lab scientists on krill identification, abundance, and distribution from the mid-water trawls and EK500 acoustic transects.
The number of young market squid caught in the midwater trawls was relatively low compared to previous surveys. In comparison to last year, there were more Market squid caught. This year there were 5248 *Loligo* sp. caught in 66 out of 145 hauls, while last year there were 2002 Market squid caught in 35 out of 118 hauls. 2003 was one of the lowest years in our survey's records for Market squid catches.
Krill identification, and abundance from the midwater trawls was determined while underway. Krill identification, abundance, and distribution based on the EK500 acoustic data will be determined by the University of California at Santa Cruz cooperating researchers.

Table 3 lists the total catch numbers for Loligo squid during the surveys since 1987. Table 4 lists the total numbers of juvenile rockfish caught during the surveys since 1986.

The biomass of rockfish stocks has decreased along the west coast of North America, and the fishery has been declared a disaster. The decline is partially due to a long series of poor recruitments during the 1990s. Fishery managers are now faced with setting fishery quotas that will minimize economic hardships while rebuilding these fish stocks. In regards to rockfish which comprise many of the species in the Groundfish Management Plan for the West Coast, this

survey provides a three to seven year advance assessment of recruitment strength for rockfishes and other groundfish. Knowledge of recent and future recruitments allows more accurate stock assessments, rebuilding analyses, and management projections, helping fishery managers in setting optimal harvest levels.

2. Biological and Physical Oceanographic Data Collections:
CTD deployments to 500 meters depth or 10 meters from the bottom, whichever was shallower, were made throughout the survey transects region, usually at 10 nm spacings and at each trawl station. 266 successful CTD casts were made during the cruise. Niskin bottle seawater samples were collected at depths during several CTD casts per day. Samples of seawater from the CTD casts were frozen for nutrient analysis and 200 ml of each water sample was immediately filtered for chlorophyll and fluorometer calibrations. Seawater temperature, salinity, and fluorometry recordings from a 3 meter depth were made nearly continuously while underway and were combined with dates, time, and the Ship's geographic positions.
Contour charts for ocean temperature, salinity, and chlorophyll will be produced and analyzed for subsequent publication. Surface weather conditions were variable throughout the cruise with periods of upwelling favorable conditions separated by calm wind conditions. Calm conditions during the cruise were conducive to phytoplankton patchiness. Near-surface Chlorophyll levels showed much variability with strong pulses off of Pescadero, Pt. Reyes and Bodega Bay where chlorophyll concentrations were the highest. Phytoplankton showed ubiquitous mixing in the surface layers over the continental shelf during Leg 4 due to strong mixing by persistent northerly winds.
Acoustic data were collected throughout the cruise while underway, using the Simrad EK500. The data are being used for various studies cooperatively between the NOAA NMFS Santa Cruz Lab and the Ocean Sciences Department of the University of California at Santa Cruz, which include acoustic target identification/differentiation, and krill abundance/distribution.
Acoustic Doppler Current Profiler data were collected throughout the cruise while underway, using the RDI ADCP instruments. 40 ensembles, comprising 12 Mb of ADCP data were collected and saved to disk.

3. Map the Distribution and Abundance of Krill Along the Continental Shelf Break Between Point Reyes and Monterey Bay:
Acoustic data are being used for various studies cooperatively between the NOAA NMFS Santa Cruz Lab and the Ocean Sciences Department of the University of California at Santa Cruz, which include acoustic target identification/differentiation, and krill abundance/distribution. The following transects and transits were daytime periods of continuous, 9-10 knot Ship speed under favorable EK 500 acoustic-recording conditions:
May 9 - South to North acoustic transect inside Monterey Bay
May 26 - Transiting off Pescadero while making freshwater
May 27 - Transiting around the Gulf of the Farallones while making freshwater
June 3 - Transit from San Francisco to Davenport
June 6 - Transit from Point Conception to San Nicolas
June 8 - Transit from San Nicolas to San Miguel
June 9 - Transit from San Miguel to San Clemente

4. Seabird and Marine Mammal Observations.

During Legs 1 and 2 trained observers from PRBO Conservation Science (formerly Point Reyes Bird Observatory) used standardized population censussing techniques to survey the distribution and abundance of marine birds and cetaceans in the study area. Observations were conducted by Cornelia Oedecoven and Sophie Webb of marine birds and mammals from the flying bridge during all daylight hours, from 4-20 May. Observations for the period are summarized in Tables 1 and 2. Large numbers marine mammals were observed during the survey period, in part because of the more southerly transects covered by the cruise this year. Nonetheless, the number of small cetaceans observed was remarkable, and the 221 Northern Right Whale Dolphins was unusual. Almost 16,500 seabirds were identified. Noteworthy are the large numbers of Pink-footed Shearwater, Black-footed Albatross, and Sabine's Gull, all species of conservation concern.

Table 1 Observations of seabirds on legs 1-2 (4-20 May)(PRBO Conservation Science)

NMFS JUVENILE ROCKFISH SURVEY

Top 20 Seabird Species	Total Observed	% Of Total Seabirds Observed
Sooty Shearwater	9,169	56.1%
Common Murre	1,969	12.0%
Red-necked Phalarope	1,307	8.0%
Western Gull	881	5.4%
Pink-footed Shearwater	684	4.2%
Cassin's Auklet	611	3.7%
Northern Fulmar	461	2.8%
California Gull	364	2.2%
Black-footed Albatross	184	1.1%
Sabine's Gull	154	0.9%
Whimbrel	114	0.7%
Brandt's Cormorant	72	0.4%
Bonaparte's Gull	71	0.4%
Unidentified Gull	66	0.4%
Rhinoceros Auklet	42	0.3%
Brown Pelican	30	0.2%
Common Loon	16	0.1%
Pacific Loon	15	0.1%
Unidentified Phalarope	15	0.1%
Arctic Tern	14	0.1%
Total Seabirds Observed*	16,355	

*Total represents sum of all seabird species observed (including all other species not listed)

Table 2 Observations of marine mammals on legs 1-2 (4-20 May)(PRBO Conservation Science)

NMFS JUVENILE ROCKFISH SURVEY

Top 5 Mammal Species	Total Observed	% Of Total Mammals Observed
Risso's Dolphin	680	30.5%
Pacific White-sided Dolphin	497	22.3%
Common Dolphin	450	20.2%
Northern Right Whale Dolphin	221	9.9%
California Sea Lion	86	3.9%
Total Mammals Observed*	2,227	

*Total represents sum of all mammal species observed (including all other species not listed)

During Leg 4 (30 May - 2 June) two observers working for H.T. Harvey and Associates used standardized population census techniques to survey the distribution and abundance of marine birds and mammals. Due to rough weather/sea conditions, the JORDAN was not underway for half of the days scheduled for Leg 4. Only 288.4 km were surveyed by the seabird/marine mammal observers. A total of 14 seabirds and 9 marine mammals were identified to species and overall, the sooty shearwater (*Puffinus griseus*) and Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) were the most numerous species. Of the total number of birds counted (3803), 80% were the Sooty shearwaters (3060); 10% were the common murre (*Uria aalge;* 413); 3.2% were the western gull (*Larus occidentalis*; 123); 1.6% were the Cassin's auklet (*Ptychoramphus aleuticus*; 62); 1.3% the Pink-footed shearwater (*Puffinus creatopus)*; 51); 0.6% were the Black-footed albatross (*Phoebastria nigripes*; 23). Also sighted were a few Brandt's cormorants (*Phalacrocorax penicillatus*), California gulls (*Larus californicus*), Pigeon Guillemots (*Cepphus columba*), Brown pelicans (*Pelecanus occidentalis*); and one sighting each of a Xantus murrelet (*Synthliboramphus hypoleucus*), South polar skua (*Catharacta maccormicki*), and Red-billed tropic bird (*Phaethon aethereus*).
Of the total number of marine mammals counted (206), 81% were the Pacific white-sided dolphin (167) and 9.7% were the Humpback whale (*Megaptera novaeangliae*; 20). We also had a few sightings of Northern right-whale dolphin (*Lissodelphis borealis*), Risso's dolphin (*Grampus griseus*), Dall's porpoise (*Phocoenoides dalli*), Gray whale (*Eschrichtius robustus*), one unidentified large baleen whale, Harbor seal (*Phoca vitulina richardsi*), and California sea lion (*Zalophus californianus*).

5. Collection of Adult Groundfish Species for Ecological and Natural History Characteristics: Four afternoons were spent hook and line fishing in support of the Central California Groundfish Ecology study. Various members of the crew and scientific staff participated. Four areas were visited: Natural Bridges, Davenport, Fanny Shoals, and Cordell Bank. A total of 209 adult groundfish were caught from seventeen species. Of particular interest to the study were several very small specimens of gopher rockfish, yellowtail rockfish, copper rockfish, and china rockfish. These specimens are particularly valuable since we have never caught them this small, as adults, before.

PIGGYBACK PROJECTS:

1. Radiography of Juvenile Hake by Mark Henderson , University of WA**:**
During the juvenile rockfish survey aboard the David Starr Jordan Mark Henderson radiographed 46 Pacific Hake (*Merluccius productus*) for use in his Master's thesis. Mark is examining the target strength (acoustic reflectivity) of Pacific hake to improve the accuracy of acoustic abundance estimates of this species. As the length of the fish is the factor that most affects the target strength of the fish, it is important to have as wide a length range as possible. Aboard the David Starr Jordan Mark collected fish ranging in length from 181 mm-617 mm, filling in a number of apparent gaps in the data. Radiographs taken during this cruise provide images of a fish's swim bladder, which reflect 90-95% of the sound from an individual fish. Tracings of the radiographs will be used in a backscatter model, which predicts the target strength of a fish at various tilt angles and acoustic frequencies.

2. Side-by-side gear comparisons with the PWCC vessel EXCALIBUR:
Between May 25 and May 29, four nights of synchronized trawls were conducted with a total of 18 comparable trawls deployed. The transects covered during these 4 nights were Davenport, Pescadero, Inside Gulf of the Farallones, and Outside the Gulf of the Farallones. Simrad ITI acoustic net sounder systems were used by both vessels during the synchronized trawls. Total catches from the 18 synchronized trawls for salient species on the JORDAN (EXCALIBUR) were:
Juvenile Rockfish - 540 (457)
Adult-Juvenile Hake - 655 (563)
Young of the Year Hake - 6729 (4166)

3. Market Squid Collections:
15 Market Squid (*Loligo opalescens*) were immediately preserved (frozen) from each trawl, in which squid were caught, and transferred to UC Santa Cruz krill researchers after the cruise. Dorsal mantle lengths were also measured for squid from the trawls in which they were caught. Pre-frozen weights and dorsal mantle lengths were taken on 150 individuals for the NOAA Fisheries La Jolla Laboratory. The 150 individuals were frozen as soon as possible after the trawl and delivered to the La Jolla Laboratory after the cruise for ageing studies.

DISPOSITION OF DATA:

1. Juvenile rockfish, CTD, SIMRAD EK500, chlorophyll, thermosalinometer, ADCP, data and profiles - Keith Sakuma, NOAA NMFS, 110 Shaffer Road, Santa Cruz CA 95060

2. Juvenile salmon specimens and data - Bruce MacFarlane, NOAA Fisheries, 110 Shaffer Road, Santa Cruz, CA 95060

3. Seabird and marine mammal data - (Legs 1 and 2) Bill Sydeman, Point Reyes Bird Observatory, 4990 Shoreline Hwy, Stinson Beach, CA 94970; (Leg 4) David Ainley, H.T. Harvey and Associates, 3150 Almaden Expressway, Suite 145, San Jose, CA 95118

SCIENTIFIC PERSONNEL:

Leg 1 (May 4 - May 14)

Stephen Ralston, Fish Biol, NMFS-Santa Cruz, CA (Chief Scientist)
Ken Baltz, Oceanographer, NMFS-Santa Cruz, CA (Cruise Leader)
Keith Sakuma, Fish Biologist, NMFS-Santa Cruz, CA
Don Pearson, Fish Biologist, NMFS-Santa Cruz, CA
Jason Mulsow, Krill Scientist, UC Santa Cruz, Santa Cruz, CA
Heidi Fish, Fish Biologist, NMFS-Santa Cruz, CA
Cornelia Oedecoven, PRBO Conservation Science, Stinson Beach, CA
Sophie Webb, PRBO Conservation Science, Stinson Beach, CA

Leg 2 (May 14 - May 21)

Stephen Ralston, Fish Biol, NMFS-Santa Cruz, CA (Chief Scientist)
Keith Sakuma, Fish Biologist, NMFS-Santa Cruz, CA (Cruise Leader)
Don Pearson, Fish Biologist, NMFS-Santa Cruz, CA
Nancy Gong, Krill Scientist, UC Santa Cruz, Santa Cruz, CA
Heidi Fish, Fish Biologist, NMFS-Santa Cruz, CA
Mark Henderson, Graduate Student, Univ. of Washington, Seattle, WA
Florian Koch, SFSU-Romberg Center for Env., Tiburon, CA
Cornelia Oedecoven, PRBO Conservation Science, Stinson Beach, CA
Sophie Webb, PRBO Conservation Science, Stinson Beach, CA

Leg 3 (May 23 - May 30)

Keith Sakuma, Fish Biologist, NMFS-Santa Cruz, CA (Chief Scientist)
Don Pearson, Fish Biologist, NMFS-Santa Cruz, CA
John Field, FATE Post-Doc, NMFS-Santa Cruz, CA
Nancy Gong, Krill Scientist, UC Santa Cruz, Santa Cruz, CA
Ryan Weidling, NOAA NMFS & UC Santa Cruz, Santa Cruz, CA
Mark Henderson, Graduate Student, Univ. of Washington, Seattle, WA

Leg 4 (May 30 - June 6)

Keith Sakuma, Fish Biologist, NMFS-Santa Cruz, CA (Chief Scientist)
Don Pearson, Fish Biologist, NMFS-Santa Cruz, CA
Eric Bjorkstedt, Fish Biologist, NMFS-Santa Cruz, CA
John Field, FATE Post-Doc, NMFS-Santa Cruz, CA
Moira Decima, Krill Scientist, UC Santa Cruz, Santa Cruz, CA
Diane Haas, CA Dept. of Fish & Game, Monterey, CA
Carol Keiper, Ornithologist, H.T. Harvey and Associates
Ian Gaffney, Ornithologist, H.T. Harvey and Associates

Leg 5 (June 6 - June 11)

Ken Baltz, Oceanographer, NMFS-Santa Cruz, CA (Cruise Leader)
Keith Sakuma, Fish Biologist, NMFS-Santa Cruz, CA (Chief Scientist)
Eric Bjorkstedt, Fish Biologist, NMFS-Santa Cruz, CA
John Field, FATE Post-Doc, NMFS-Santa Cruz, CA
Moira Decima, Krill Scientist, UC Santa Cruz, Santa Cruz, CA
Yasmin Lucero, Student - UCSC & Sea Grant Fellow, Santa Cruz, CA
Heather Constable, Student, San Francisco State University, San Francisco, CA

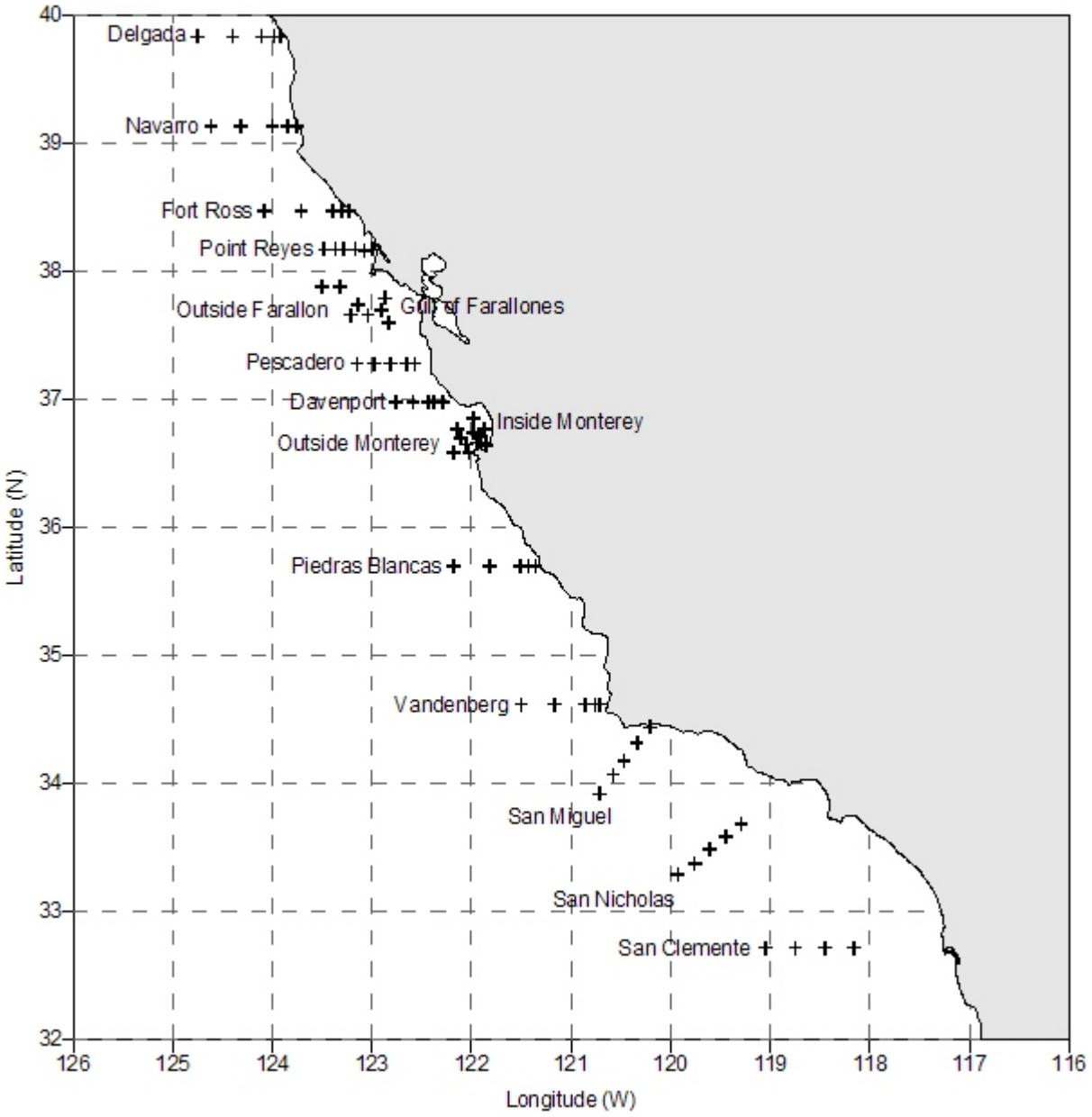

Figure 1 Trawl Stations Along All Transects of the Survey, Each Cross Represents a Night- Time Midwater Trawl Station

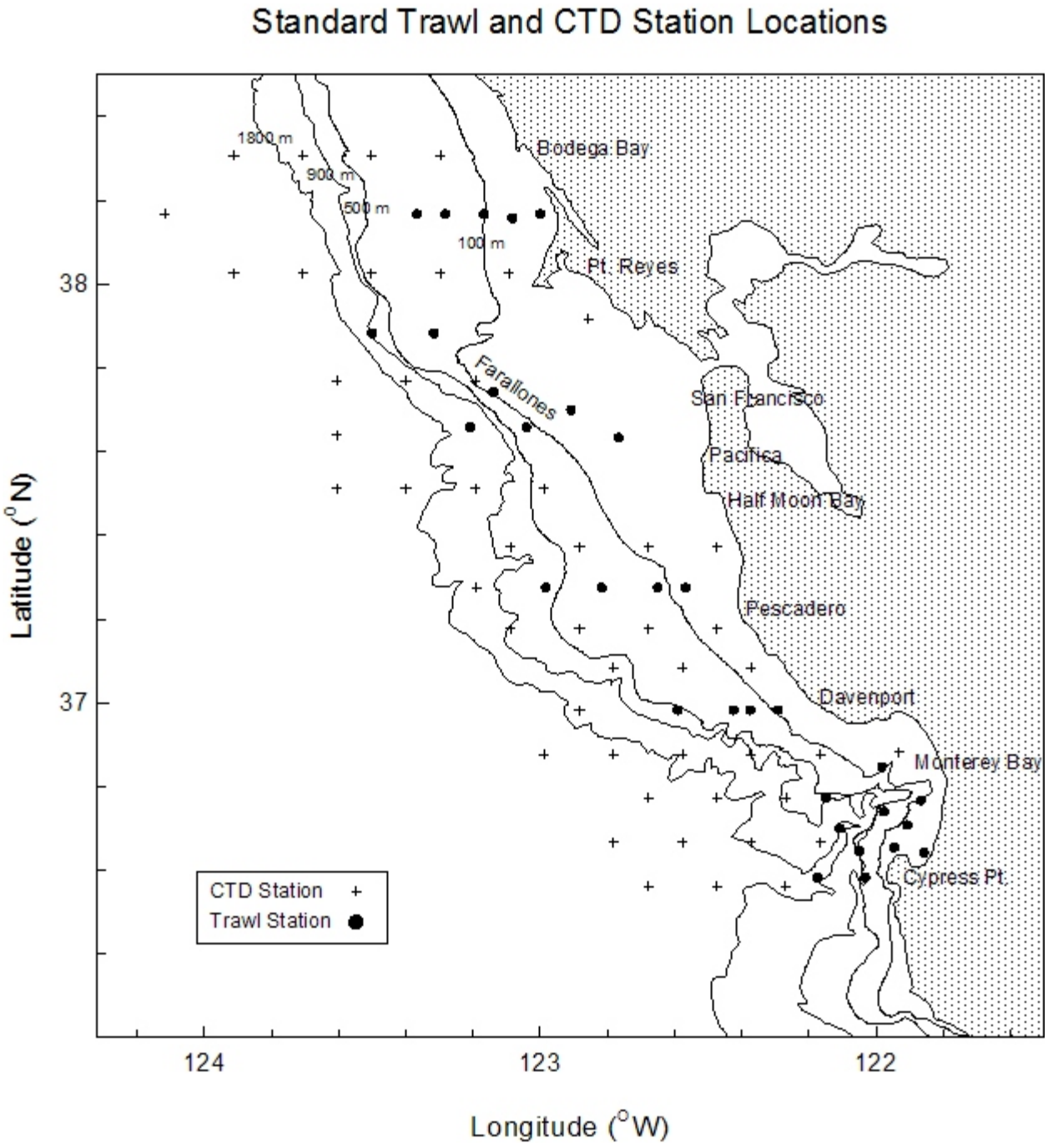

Figure 2. Survey's Standard Sampling Stations for Trawls and CTDs off Central CA

Table 3 Number of Loligo spp. Squid Collected by Midwater Trawl at Standard Stations During May-June Cruises (1987-2004)

YEAR	TOTAL CATCH
1987	33906
1988	14082
1989	7929
1990	5242
1991	74719
1992	45308
1993	9396
1994	4460
1995	11684
1996	4014
1997	6055
1998	240
1999	1140
2000	5199
2001	26407
2002	8721

Table 4 Number of Pelagic Young-of-the-Year Rockfish Collected by Midwater Trawl at Standard Stations During May-June Cruises (1986-2004)

SPECIES	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04
Shortbelly	9104	6865	107962	1598	4479	2422	2838	2287	949	276	1848	784	69	124	2016	3403	995	206	1306
Chilipepper	54	586	4418	24	66	343	90	1251	3	32	17	12	3	27	27	126	286	85	212
Brown	470	10	-	3	19	265	7	1226	15	5	32	2	-	2	5	117	58	95	27
Widow	11	424	257	13	296	623	1	101	24	25	-	49	1	81	80	193	858	227	1247
Squarespot	4	177	380	16	649	47	70	25	2	-	-	1	-	-	-	36	16	1	14
Canary	46	71	162	39	23	618	-	14	3	-	-	3	-	38	9	31	258	31	314
Blue	4	196	366	63	38	220	3	38	11	7	4	5	-	9	10	67	341	140	468
Stripetail	2	194	30	6	22	175	5	315	9	6	2	27	14	31	11	185	352	18	213
Bocaccio	327	106	60	22	44	114	5	26	4	3	1	7	1	15	24	51	71	2	35
Yellowtail	22	85	69	31	27	281	5	31	8	27	3	6	6	1	10	30	58	68	838
Copper complex	9	9	1	-	1	15	116	82	54	7	10	42	4	2	4	25	5	-	5
Halfbanded	1	9	-	2	77	8	1	5	2	-	6	68	-	1	-	96	7	-	4
Pygmy	2	15	9	12	10	62	8	2	3	-	1	2	-	1	3	34	37	8	25
Black	1	22	19	5	4	34	-	6	2	7	7	-	1	5	1	2	29	23	294
Olive	-	4	2	6	18	-	-	6	1	-	-	-	-	-	-	13	5	-	7
Darkblotched	-	7	5	-	1	9	-	9	-	2	-	-	-	2	1	1	6	3	19
Cowcod	1	17	1	1	-	-	5	5	-	-	-	-	-	-	-	-	2	1	5
Bank	-	18	4	-	-	-	-	5	-	-	-	-	-	-	1	1	3	-	1
Sebastomus	2	7	3	-	1	3	8	-	-	1	2	27	-	-	2	2	2	3	423
Splitnose	1	4	-	-	1	-	19	-	-	-	-	10	-	1	3	-	-	-	1
Puget Sound	-	-	-	-	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-
Sharpchin	-	-	-	-	-	-	2	-	14	-	-	-	-	1	-	1	3	-	-
Grass	1	1	-	-	-	-	8	2	1	-	-	-	2	-	-	3	-	-	-
Quillback	2	1	-	-	-	6	-	-	2	-	1	-	-	-	-	-	-	-	-
Vermillion	-	4	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	-	-	-	-	-	-	1	-	-	-	6	-	-	-	-	-	-	-	-
Greenspotted	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Greenstriped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30
Blackgill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62
Aurora	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	2
Unknown	40	5	-	-	2	4	49	31	13	13	31	49	14	25	29	55	2	45	337
Totals	**10104**	**8837**	**113748**	**1841**	**5779**	**5290**	**3242**	**5467**	**1120**	**411**	**1971**	**1095**	**115**	**366**	**2236**	**4472**	**3394**	**956**	**5889**

DATE:_____10-21-2004_____

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